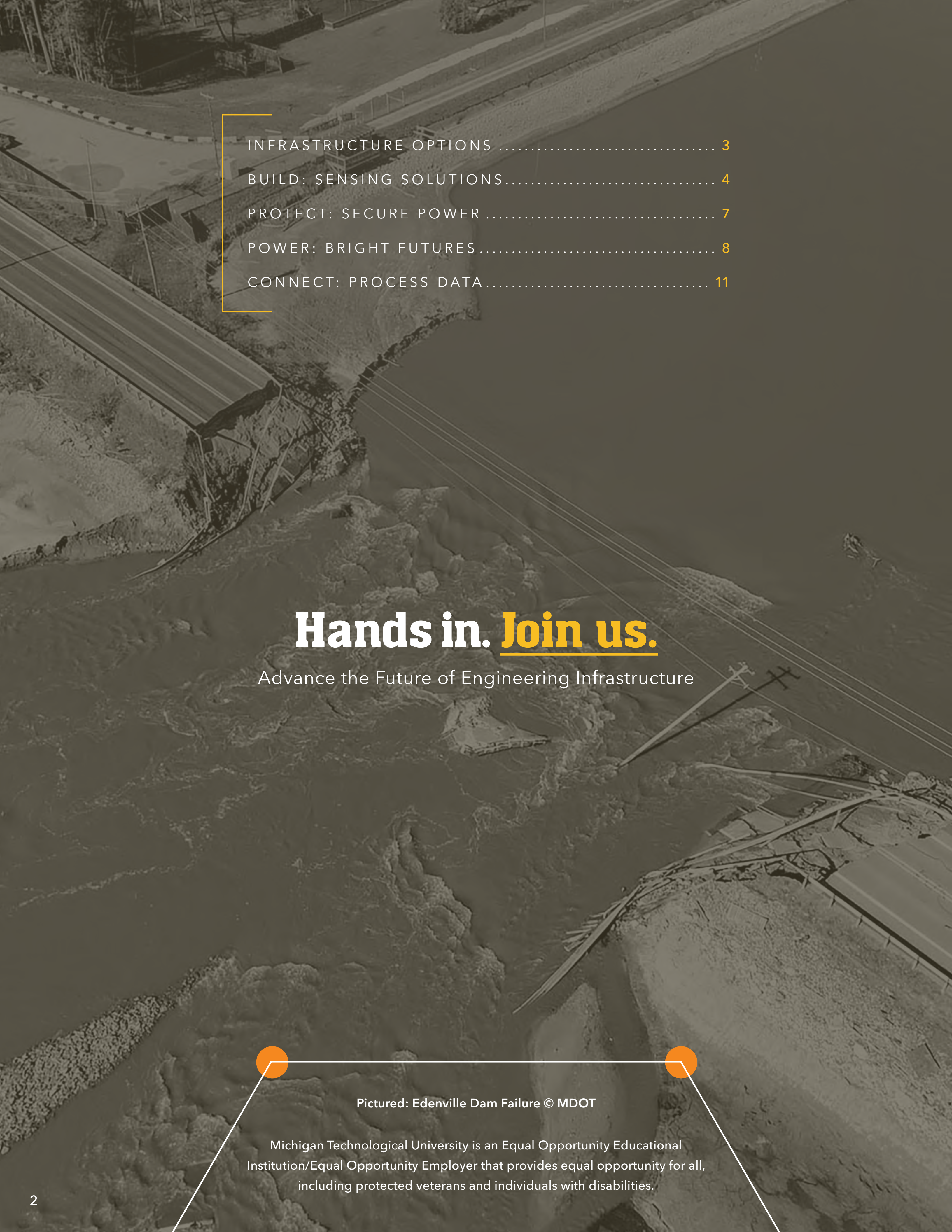
Sense. Learn. Power.

Michigan Technological University
1885

COLLEGE OF ENGINEERING
ENGINEERING INFRASTRUCTURE
INITIATIVES

Hands in. Join us.

Advance the Future of Engineering Infrastructure



Pictured: Edenville Dam Failure © MDOT

Infrastructure Options

LEARN WITH TECHNOLOGY

Our graduates find new ways to draw power from sun, wind, waves, and traditional fuels. We prepare them to power the world.

We collaborate to enhance renewable energy solutions, adapt renewables to present-day power systems, improve road and railroad safety, lead in vehicle-to-vehicle communication, and bring visibility to the challenges associated with securing our connected power systems.

We need support to update the tools and equipment our students use, add interactive instrumentation to monitor building health and power usage, and build research partnerships on land, sea, rail, and air.

Build

SENSING SOLUTIONS

Advances in technology create opportunities to reduce roadway congestion and improve safety with integrated systems.

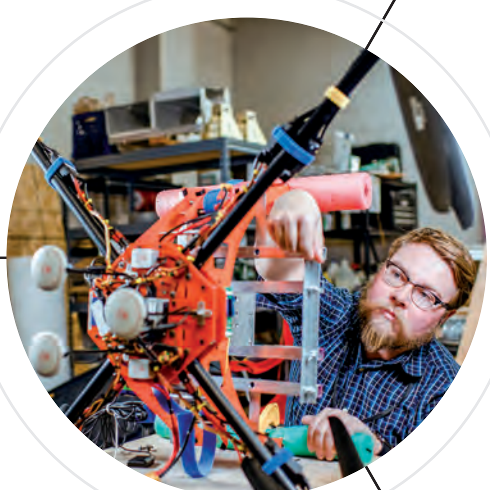
Smart devices inside vehicles act as connected mobile sensors. These can ultimately provide better service by reducing congestion, monitoring density, analyzing traffic patterns, and sharing information between vehicles to reduce accidents.

Building innovative solutions informed by data is critical in intelligent roadways, railways, and building decisions.

We aim to use vehicle-to-infrastructure technologies to inform management systems. Knowledge of the speed and acceleration of surrounding vehicles enables us to explore cooperative driving across a regional network.

To do this, we use external sensors in fixed cameras and drones to train machine learning models for optimizing traffic signals and flow controls. Our findings, paired with mobile sensor data, have the potential to redefine transportation infrastructure—to ensure the supply is meeting the coordinated demands of all citizens.

Our research impacts transportation beyond our roadways, as well. Railroad safety has come to the forefront with systems monitoring at crossings to reduce congestion and improve safety. Using in-vehicle technology and a roadside unit, we test the efficacy of broadcasting information and signals to vehicles approaching train crossings in order to proactively suggest reroutes for longer train crossings.



Building innovative solutions informed by data is critical in intelligent roadways, railways, and building decisions. To further enhance safety measures through data collection, we need access to intelligent systems and sensors.

Our laboratory spaces are in need of updates to ensure our students learn on the best industry-standard equipment and Doble testing systems.

Protect

SECURE POWER

As more technology is added to our infrastructure, it becomes increasingly important to protect the data, buildings, vehicles, and power grids that analyze and advise the systems.

Using real-time simulations for hardware-in-the-loop and rapid control prototyping, we develop new algorithms to protect critical data.

In addition to research on protection, we introduce our students to concepts of monitoring through the Power Systems and Protections Lab, where they learn to set relays to protect power systems from overload.

We analyze smart grids to solve the gaps between a physical piece of equipment and the intangible software running the systems. We guide our students through plausible scenarios—hackers finding security vulnerabilities. We also explore automation and interconnectedness and its associated societal impacts.

Students interested in the future of protecting the grid can seek a graduate certificate in safety and security of autonomous cyber-physical systems, which covers networked and autonomous mobile systems for land, air, and water.

To support the real-time simulation data capacities, we need increased computational power in lab spaces. Funding for advancing technologies—along with support for student research—are essential to guiding our students with the future in mind.

Power

BRIGHT FUTURES

Generating power—through traditional means or through renewable energy sources—is at the core of the student learning at Michigan Tech.

As the existing workforce looks toward retirement, enabling student learning of both traditional and new, renewable energy solutions is critical. Advancements in infrastructure, mobility, and the internet of things will ultimately impact the grid and lead to increased dependence on electric power.

We explore not only how wind farms are constructed, but also how wind turbine blade dynamics impact generation efficiency. One solution for wind turbine optimization: adding a DC-to-AC converter for the entire wind turbine grid, rather than having a converter on every individual turbine and exploring electrical phasing to reduce energy storage.

Solutions are also being explored in positioning turbines in the wake of one another to intensify certain wind profiles. Armed with improvements to efficiency, reliability, and reduced maintenance, we hope to inform the manufacturing process, reducing the cost of wind farm installation.

To fully teach our students about power, we need to install more solar panels and microturbines at Michigan Tech. This will enable us to establish an electrical control center for operator training, while also investigating power usage across campus. Engaging students with hands-on learning is essential.

We need equipment and upgrades for laboratory spaces, including our Power Electronics Lab to ensure students become familiar with the tools they'll see in industry. Additional funding for undergraduate and graduate research will provide our students with support they need to graduate and make a difference.


OUR PARTNERS:

Connect

PROCESS DATA

The future of bridges, buildings, roadways, and autonomous vehicles lies in smart and interconnected systems.

We seek opportunities to connect devices, optimize infrastructure, and assist in disasters.

With a focus on unstructured environments in hostile areas or natural disasters, we develop autonomous microgrid robots that can assemble an electric grid. Questions and possibilities are constantly being explored in optimizing power lines, connecting the system, controlling the grid, and adjusting on the fly.

To provide power to the grid, we also explore wave energy converters as a renewable energy source, using our large, state-of-the-art wave tank. Hands-on learning in our labs enhance student experiences, from senior design projects to faculty research on wave energy extraction, hydrodynamics, wave field estimation, and more.

Communication is one of the core challenges in disaster relief. We are working to establish new tools for communities, first responders, and state and federal agencies, enabling them to make informed decisions on resource allocation during emerging disasters.

Our focus on structural health monitoring collects and interprets data on embedded, autonomous, or civil infrastructure. This work enables better protection of buildings, bridges, pipelines, turbines, roadways, and railroads. For this monitoring to be successful, we need an efficient solution for collecting data, analyzing the structural health, estimating force loads, embedding algorithms, and using wireless sensor technology applications.

Our future is connected. We need research opportunities and equipment to adapt algorithms, build sensors, analyze data, and maintain enough computational power to process the information.


Hands on.
Hands in.
MicroAutoBox